...for the safe, secure and environmentally compliant disposal of recovered, abandoned or expired munitions.
DAVINCH Experience
Internationally Proven Technology

Completed
In operation
Under design/construction
Installed, never operated
DAVINCH Capability

Conventional munitions,
   Abandoned or recovered munitions
   Off spec, or shelf life expired munitions

Chemical munitions
   Leakers,
   Overpacked munitions,
   M55 Nerve agent rockets, simulant filled

Other categories of munitions,
   Smokes and Incendiaries
   Missiles
Basic DAVINCH System

Munitions -> Donor Charge -> Evacuation

- Minimum oxygen supply
- Detonation off-gas (CO, H₂, etc.)
- Detonation
- Fragments
Structural Advantage

- Double Walled Chamber Structure
- Laminated Steel Construction
- “Leak- Before-Burst” Mode of Failure Design
- Real-Time Fatigue Damage Monitoring System
Double-Walled Chamber

Inner Chamber: sacrificial layer for protection against fragments

Outer Chamber: High Pressure Vessel
Unique Laminated Steel Construction

Detection hole to monitor the leakage from the 1\textsuperscript{st} layer

Removable Inner Vessel
Leak-Before-Burst Mode of Failure

Design based on New ASME Rule for Detonation Chambers

ASME: American Society of Mechanical Engineers
New ASME “Leak- Before –Burst” Mode of Failure Certification

Example of Burst-Before-Leak, Antithetical Phenomena of Leak-Before-Burst
Real-Time Fatigue Damage Monitoring System

“DESTINY”

Dynamic Analysis

Selection of Points of Interest

Real-time Strain Measurement

Preparation of Strain Wave by single Detonation

Calculation of cumulative Fatigue Damage $\Sigma n/N$ for single Detonation

Calculation of Total cumulative Fatigue Damage $\Sigma \Sigma n/N$ for all experienced Detonations

Monitoring of time to crack initiation

Information for scheduling of Maintenance/Repair/Replacement
Environmental Compatibility

- Incineration Free Process
- High Destruction Efficiency of Chemical Agent
- Closed System of “Hold, Test and Release”
- No Dioxin Generation
- Safe Containment of Heavy Metals and Mercury
- Minimum Secondary Waste
Off-gas Treatment Options

The off gas system is tailored/simplified depending upon munitions to destroyed and local regulations.
Closed System of “Hold, Test and Release”

Detonation chamber

All off gases are compressed and held for analysis. Non-compliant batches are recycled until clean.

Monitor

Test

Holding Tank
High Destruction Efficiency

Detonation Chamber

99.9999 %
(Principal Destruction)

Sulfur Impregnated Carbon

>99.99 %
(Additional Margin)

99%
(Back-up)
Low Volume of Secondary Waste

Solid Waste:
Fragments from munitions.
Collected with magnetic sweeper, stored and “head space” analysis conducted.

Liquid waste:
Water generated from hydrogen in the explosive.
Reused in off-gas neutralization column.
At Port Kanda project, all the rain water is collected in pits.
Expendable Materials Waste

- Secondary waste can be destroyed in the DAVINCH

HEPA filter

Charcoal filter
Current Deployment Sites
2014
DV65 at Port Kanda, Japan

~3,000 Sea Dumped Chemical Weapons of WW II
(65 kg or 146 lbs of TNT eq)
DV50 at Poelkapelle, Belgium

~4,000 Recovered Chemical Weapons of WW I
(50 kg or 110 lbs of TNT eq)
Example Munitions at Poelkapelle

One 201cm (8.3”) German Clark shell at one shot
Munition Preparation at Poelkapelle

Six 10.5cm (4.1”) German Clark shells at one shot
Two DV65s at Nanjing, China

~36,000 Abandoned Chemical Weapons of WW II (65 kg or 146 lbs of TNT eq)

Tandem Operation for Increased Production
French SECOIA Project

- Fully automatic System
- 20 year project
- Destruction of 600 tons of chemical munitions of WW II.
Detonation Test of DV60 for DDESB

Department of Defense Explosive Safety Board

125% load of 60 kg (75kg=165lbs)
Looking to the Future

DAVINCH *Lite*

*A compact unit designed to be easily rod transportable and rapidly installed.*
The Latest Model of the DAVINCH Series

**7th Generation**
- Mobile DAVINCH\textsuperscript{lite}

**6th Generation**
- DV60 for Tooele

**5th Generation**
- DV50 for Poelkapelle

**4th Generation**
- DV65 for Kanda

**3rd Generation**
- DV60 for Kanda

**2nd Generation**
- DV45 for Kanda

**1st Generation**
- Mobile DV10
  - Lake Kussyaro
DAVINCH Lite Chamber
Mobile DAVINCH lite

Outer Diameter: 2.1 m
Total Length: 7 m
Weight: 45 tons

Self Unloading System by Outrigger
Novel Outrigger Design for Unloading

No crane is required for installation
Off gas Treatment Modules

Assembled in 20ft. Standard Conex Frames
Designed for Road, Ship or Air Transportation
Summary

DAVINCH is…

- Environmentally friendly process, driven by Closed System of “Hold, Test and Release”

- Structurally robust chamber, design by ASME “Leak-Before –Burst” mode of failure

- Historically proven process, demonstrated by destruction of ~43,000 chemical munitions and numerous recovered conventional munitions in Belgium.

- Well experienced process, developed, designed, manufactured and operated by Kobe Steel

- Mobile Application is ready for conventional munitions destruction